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स्वचल वाहन — शक्यांतरण विशिष्टि पर स्पार्क दहन इंजिनों से युक्त वाहनों से कार्बन मोनो-ऑक्साइड सांद्र के मापन का उपकरण — विशिष्टि

Indian Standard

AUTOMOTIVE VEHICLES — EXHAUST EMISSIONS — APPARATUS FOR THE MEASUREMENT OF CARBON MONOXIDE CONCENTRATION FROM VEHICLES EQUIPPED WITH SPARK IGNITION ENGINES AT IDLING — SPECIFICATION

ICS 43.060; 13.040.50

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 1998

Price Group 4

Automotive Primemovers Sectional Committee, TED 2

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Primemovers Sectional Committee had been approved by the Transport Engineering Division Council.

The increasing emphasis on environment necessitated formulation of standards outlining the methods of measurement of different facets of emissions such as exhaust, evaporative and crank case emissions. The methods inturn suggest instrumentation that can measure the limits with accuracy, repeatability and reproducibility. In view of the above, a need to evolve a standard for type approval of the equipment required to check the carbon monoxide emissions at idling for spark ignition engines (gasoline) specifying the technical requirements and test procedures was felt by the committee.

While preparing the standard considerable assistance has been derived from the following:

ISO 3930 : 1993	Road Vehicles — Measurement equipment for exhaust gas emissions during inspection or maintenance — Technical specifications
Annexure I of Ranganathan Committee Report	Details of Standards and Test Procedures for Carbon Monoxide Emissions at idling for in service vehicles fitted with petrol engines (Part I of Doc No. MOST/CMVR/TAP/115-116)

The committee responsible for preparation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AUTOMOTIVE VEHICLES — EXHAUST EMISSIONS — APPARATUS FOR THE MEASUREMENT OF CARBON MONOXIDE CONCENTRATION FROM VEHICLES EQUIPPED WITH SPARK IGNITION ENGINES AT IDLING — SPECIFICATION

1 SCOPE

This standard specifies the requirements and methods of test for type approval of the equipment used for the measurement of concentration of carbon monoxide (CO) at idling in the exhaust from automotive vehicles equipped with the spark ignition engines.

2 REFERENCES

2.1 The following Indian Standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
9000 (Part 8) : 1981	Basic environmental testing procedures for electronic and electrical items : Part 8 Vibration (sinusoidal) test
9057 : 1997	Automotive vehicles — Exhausts — Carbon monoxide concentration at idling for vehicles equipped with spark ignition engines — Method of measurement (*second revision*)

3 DESIGN AND CONSTRUCTION

3.1 The instrument shall be designed and constructed to provide reliable and accurate service in the vehicle repair garage/service stations.

3.2 The instrument used shall be permanently mounted, portable or mobile meeting the requirements of the user.

3.3 Sampling System

The vehicle exhaust gas sampling system shall consist of an exhaust pipe/probe and an analysis system and may include a water removal system and/or filter(s). The length of the sampling line shall not be less than three metres.

3.3.2 *Probe*

The probe design shall be such that, it does not slip out of the vehicle exhaust pipe when in use for analysis. A thermally insulated hand grip shall be provided on the sample probe handle. The probe shall be flexible enough to get inserted into the tailpipe for at least 300 mm.

3.3.3 *Water Removal System*

If a water removal system is required for removal of water vapour from the sample gas obtained from vehicular exhaust, prior to its entry to the instrument analyser, the collection vessel provided shall be visible to the operator and it shall be equipped with a provision for draining also.

3.3.4 *Sample Handling System*

3.3.4.1 The sample handling materials that are in contact with the gas sample shall not contaminate or change the character of the gases to be analysed.

3.3.4.2 All sampling system internal surfaces shall be corrosion resistant to vehicle exhaust gases.

3.3.4.3 The sample handling system shall provide for particulate and water removal as required to prevent these contaminants from affecting gas analysis. The filtering and water removal components shall be designed for easy maintenance.

3.4 Span Techniques

3.4.1 The instrument system shall have provision for adjustment of zero and span setting by calibration gas. A second type of span adjustment by electro-mechanical, electrical, electronic or any other acceptable method shall also be provided. For the instrument with automatic zero and span adjustment, its equivalence to the electro mechanical or electronic methods has to be established by the manufacturer.

3.4.2 If the instrument is not self-compensated for non-standard conditions of altitude and ambient temperatures or not equipped with a manually controlled system of compensation, the scale of calibration shall be performed using calibration gas.

3.4.3 The carrier gas shall be dry nitrogen. The accuracy of the span gas blends shall be within ± 2 percent of the concentration specified.

3.4.4 The span and zero controls shall be readily accessible but protected against accidental maladjustment.

3.5 The construction, materials and electrical systems used in the instrument system shall incorporate safety devices for protection of the personnel and nearby equipment.

3.6 Analytical System

The accuracy, system response time, drift, repeatability and warm up time shall be as specified in **4**.

3.7 Battery Operation

The instruments powered by battery shall be equipped with state of battery charge/discharge indicators.

3.8 Operating Instructions

3.8.1 Concise operating instructions including the calibration procedures and instrument calibration curves shall be supplied by the manufacturer along with the instrument.

3.8.2 Prior to testing, the manufacturer shall supply the following information:

- Detailed specifications of the equipment along with standard accessories/fitments,
- Operating manual,
- Service manual,
- Flow/schematic diagrams,
- Details of sample handling system material, and
- Photograph of the instrument.

4 PERFORMANCE REQUIREMENTS

4.1 Instrument Range

The instrument full scale range shall be between 8 and 10 percent of CO.

4.2 Warm-up Time

Unless otherwise indicated on the instrument, the analyser shall attain stabilized condition within 30 min from 'power on' condition.

4.3 Analyser Accuracy

The CO analyser shall have an accuracy of ± 3 percent of full scale value, when compared with the calibration gases of known concentration.

4.4 Interference Effects

The sum of the individual effects on the reading of the analyser from other gases and particulates in concentration close to those existing in the engine exhaust gas such as CO_2 and water shall be less than 0.2 units.

4.5 System Response Time

The analyser concentration indication shall reach 90 percent of the final stabilised reading within 10 seconds after a step change in concentration level initiated at the sample probe inlet.

4.6 Drift

Zero and span drift of a warmed up instrument shall not be greater than ± 3 percent of full scale value during 1 h of operation.

4.7 Repeatability

Analyser repeatability shall be within ± 2 percent of full scale value during five successive samples of the same gas source.

4.8 Input Power Supply

Analyser operation shall be unaffected by an electrical voltage variation of 230 V ± 10 percent or within the indicated range of the battery voltage, if battery operated.

4.9 Electromagnetic Isolation

The instrument shall be capable of providing unaffected operation in electromagnetic radiation or conductive interference produced by vehicle ignition systems and building electrical systems.

4.10 Vibration Test

The equipment operation shall be unaffected by the vibration and shock encountered under the normal operating conditions in the motor vehicle repair garage.

4.11 Temperature Sensitivity

The instrument shall be suitable for ambient temperatures between 278 K and 318 K. Between these two limits the result of the measurement shall not differ from that obtained at a temperature of 303 (± 2 K) by more than 0.2 units.

4.12 Drop Test

The test is intended to determine the suitability of the equipment for such applications where it is likely to be dropped or toppled or otherwise roughly handled. The instrument shall not be affected by an accidental fall or toppling of the equipment.

5 TEST PROCEDURE

5.1 Analyser Accuracy

The accuracy shall be checked with calibration gases of known concentration at minimum five points covering zero to full scale range. Calibration points shall be uniformly spaced as far as possible. It is preferred to test at ten points with five points below 5 percent of CO.

5.2 Interference Effects

Interference of Carbondioxide (CO_2) and water shall be checked with CO_2 gas between 12 to 16 percent concentration by the following:

- Only CO_2 gas,
- CO_2 gas bubbled through water,
- Nitrogen bubbled through water,
- CO bubbled through water, Or
- Known mixture of above all gases.

5.3 System Response Time

The total system response time, both mechanical and electrical, shall be determined with suitable instruments by passing an adequate quantity of high concentration calibration gas.

5.4 Drift

This test shall be conducted after warming up by passing a span gas having concentration more than 60 percent of the full scale value for 1 h duration.

5.5 Repeatability

This test shall be conducted after warming up by passing a span gas having concentration more than 60 percent of the full scale value five times successively.

5.6 Electro-magnetic Isolation

This test shall be conducted in the vicinity of minimum five vehicles equipped with spark ignition engines and operating within approximate distance of 3 to 5 m from the equipment. The vehicles shall not be fitted with ignition suppression devices. The instrument shall in no way get affected by those running engines.

5.7 Vibration Test

Vibration test shall be conducted as specified in IS 9000 (Part 8). Analyser shall be subjected to vibration in normal mounting axis with a constant displacement of ± 3.5 mm over a frequency range of 5-9 Hz and constant acceleration of ±1 g over a frequency range of 9-150 Hz five sweep cycles, with a sweep rate of one oct/min, preferably with electrical power 'ON' condition. The span reading with span gas having concentration more than 60 percent of full scale value, before and after the test, shall not differ by more than one percent of full scale value. Any other drift such as zero drift or span drift with time (if observed) shall be compensated.

5.8 Temperature Sensitivity

5.8.1 This test shall be conducted by passing a span gas having concentration more than 60 percent of the full scale value.

5.8.2 This test shall be conducted in a temperature controlled chamber and readings shall be obtained after allowing 2 h stabilization on attaining the specified temperatures of 278 K and 318 K. Any other drift such as zero drift or span drift with time (if observed) shall be compensated for this time interval.

5.9 Drop Test

5.9.1 With the electrical power in switch-off condition, the meter components (except those which are wall mounted) shall be positioned in their normal orientation of use on a rigid surface. They shall be tilted on one bottom edge and then allowed to fall freely on to the test surface. All covers shall be fitted properly. They shall be subjected to six drops on each edge from a height of 50 mm, measured from the elevated edge of the unit to the test surface.

5.9.2 The instrument shall be put 'on' electrically, warmed up and initial electronic calibration shall be carried out. The span reading with span gas having concentration more than 60 percent of full scale value, before and after the test, shall not differ by more than one percent of full scale value.

6 INSTRUMENTS WITH FACILITY FOR CO_2 MEASUREMENT

These instruments shall meet all the above performance criteria mentioned for CO analysis except that the instrument shall have a measurement range of zero to 20 percent or less.

7 MARKING

7.1 Each equipment shall be provided with a name plate or marking which shall convey the following information:

a) Name or trade-mark of the manufacturer;

b) Serial number of the apparatus;

c) Type or model number;

d) Rated voltage and power;

e) Month and year of manufacture; and

f) Country of manufacture.

7.2 BIS Certification Marking

The product may also be marked with the Standard Mark.

7.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Foreword*)

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